

WHAT IS CLAIMED IS:

1. A process for isolating devices on a semiconductor substrate comprising the steps of:

removing predetermined portions of the semiconductor substrate forming
5 recesses therein; and

refilling the portions of the semiconductor substrate with a material having a dielectric constant lower than the dielectric constant of silicon dioxide.

2. The process of Claim 1, wherein the step of removing portions of the semiconductor wafer comprises forming trenches in the semiconductor wafer.

10 3. The process of Claim 2, wherein the trenches have a depth of less than 200 nm.

4. The process of Claim 3, wherein the trenches have an aspect ratio of less than 2:1.

15 5. The process of Claim 1, wherein the material having a dielectric constant lower than that of silicon dioxide comprises a halide-doped silicon dioxide composition.

6. The process of Claim 5, wherein the halide-doped silicon dioxide complex comprises a Fluorine-doped silicon dioxide complex.

20 7. The process of Claim 1, wherein the refilling material has a dielectric constant less than about 3.9.

8. The process of Claim 1, further comprising forming a barrier layer over the semiconductor substrate prior to the step of refilling portions of the semiconductor substrate.

25 9. The process of Claim 8, wherein the barrier layer comprises a silicon dioxide composition.

10. The process of Claim 8, wherein the barrier layer comprises a silicon nitride composition.

30 11. An isolation structure in a semiconductor substrate comprising:
a recessed portion formed therein in the semiconductor substrate; and
a dielectric material filling the recessed portion, said dielectric material having a dielectric constant lower than the dielectric constant of silicon dioxide.

12. The isolation structure of Claim 11, wherein the recessed portion comprises a trench structure having an aspect ratio of less than 2:1.

13. The isolation structure of Claim 11, wherein the recessed portion comprises a trench structure having a depth of less than 200 nm.

5 14. The isolation structure of Claim 11, further comprising a barrier layer disposed between the recessed portion of the semiconductor substrate and the dielectric material.

15. The isolation structure of Claim 11, wherein the dielectric material has a dielectric constant lower than 3.9.

10 16. The isolation structure of Claim 11, wherein the dielectric material comprises a Fluoride-doped silicon dioxide composition.

17. A method of reducing the formation of voids in a refilled trench isolation process comprising the steps of:

15 forming trenches having an aspect ratio less than 2:1; and
refilling the trenches with a material having a dielectric constant less than the dielectric constant of silicon dioxide.

18. The method of Claim 17, wherein the trenches have a depth of less than 200 nm.

20 19. The method of Claim 17, wherein the refilling material comprises a Fluorine-doped silicon dioxide composition.

20. The method of Claim 17, wherein the refilling material has a dielectric constant of less than about 3.9.

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